Clinical Epidemiology and Global Health 8 (2020) 576–580

Contents lists available at ScienceDirect

Clinical Epidemiology and Global Health

journal homepage: www.elsevier.com/locate/cegh

Original article

The effect of an educational intervention based on the Integrated Behavior Model (IBM)on the waste separation: A community based study

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ARTICLE INFO

Keywords:
Integrated behavior model
Source waste separation
Housewife
Iran

ABSTRACT

Introduction: In the management of recycling waste, separation of the wastes from source is crucially important. A successful source separation plan requires good participation of the community.
Objective: The purpose of this study was to evaluate the effect of an educational intervention based on the Integrated Behavior Model (IBM) on the behavior change of housewives in Sanandaj City, west of Iran, towards the waste separation at source.
Methods: This is a quasi-experimental and community trail study. The population study was the households living in Sanandaj. The total number of 144 households were selected and divided into two groups (72 each). For each selected household, only the housewife was interviewed. To evaluate the behavior change towards the dry and wet waste separation, a training program based on the IBM was conducted for one group (training or intervention group) and the second group served as the control and received no training. The length of the intervention was two months with eight sessions. After a month, participants were asked to fill in a validated questionnaire based on the IBM, before and at the end of study. Data were analyzed using Wilcoxon and McNemar tests.
Results: In the intervention group at the baseline, the mean ± standard deviation of the attitude, subjective norms, perceived behavior control, and self-efficacy score were 34.03 ± 5.12, 15.91 ± 4.58, 18.93 ± 4.01 and 31.54 ± 6.79 respectively. At the end of study, the score of components increased to 36 ± 4.28, 18.9 ± 4.56, 21.76 ± 2.65 and 34.72 ± 4.66 respectively. The increase in the components was statistically significant ($p < 0.05$).
Conclusions: The intervention based on IBM could be an effective method to improve the behavior of separation the dry and wet waste.

1. Introduction

In recent decades, one consequence of urbanization and population growth have been a vast production of solid wastes.[1,2] Solid waste is known as one of the most important environmental pollutants facing human societies.[3] Inadequate management of wastes can result in water and soil pollution, greenhouse gas emissions, and negative impacts on human quality of life.[4–6] Apart from health and environmental hazards, other problems of mass production of solid wastes are waste storage, collection, and disposal management.[7]

For any municipal waste management plan to be successful, it is important to consider separation of the wastes at source where community participation plays a key role.[7] By recycling of the waste from the source, the recycling costs will reduce and efficiency of a system for returning the re-useable products into production cycle increases. Moreover, separation from source are well known for its economic and

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https://doi.org/10.1016/j.cegh.2019.12.006
Received 14 April 2019; Received in revised form 21 August 2019; Accepted 20 December 2019
Available online 27 December 2019

environmental benefits.[8] Without separation at source, recycling process to separate waste materials is costly.[9] Recycled solid components are all types of plastics, glass, paper, and cardboard, all types of textiles, metals, etc.[8]

In Iran, more than 48,000 tons of wastes are produced daily and only 8% of the wastes are recycled. The remaining is buried in non-sanitary methods. In contrast, in developed countries, 60 to 80% of waste is recycled.[10] The most cost-effective way of recycling solid wastes is the investment on the separation of wastes at source. People's environmental awareness, broad participation of citizens, and proper infrastructures are main aspects that build a successful investment.[11] Among the mentioned factors, the participation of people in recycling is one of the most important factors in the management of waste products.[7] There is certainly no success without the participation of the people. The society's behavioral mechanisms on separation wastes at source can be studied by an Integrated Behavior Model (IBM).[12] This theory provides a systematic scientific framework for determining the factors that affect behavioral change of participants. This model predicts the occurrence of typical behavior, provided that the person intends to do so.[12–17] In this model, a behavior affects by behavior intention (expressing the intentions and intention to carry out target behavior), Attitude towards behavior (positive or negative evaluation about doing a behavior), subjective norms (the social pressure perceived by the individual), perceived behavior control (the extent to which a person feels that how much, doing or not doing a behavior is under her/his will control) and self-efficacy (a person's confidence in his/her ability to succeed in a behavior).

2. Objectives

The purpose of this study was to evaluate the effect of an educational intervention based on the integrated behavior model on the behavior change of housewives in Sanandaj City, west of Iran, towards the waste separation at source.

3. Methods

3.1. Study design

The present study was a quasi-experimental and community trail study with an approved ethics code of IR.AJAUMS.REC.1396.61 by Aja University of Medical Sciences. The target community in this research was households of Sanandaj City.

3.2. Sampling

The sample size was determined using the following formula for comparison of the mean between two groups:

$$n = 2 \times \frac{\sigma^2\left(Z_{1-\beta} + Z_{1-\frac{\alpha}{2}}\right)^2}{(d)^2}$$

where n denotes the sample size of each group, σ the common standard deviation, and d the smallest meaningful difference between the means of the two groups. α and β represent type I and II error and $Z_{(1-\beta)}$ and $Z_{(\alpha/2)}$ are cumulative normal standard values correspond to the power (1-β) and the pre-defined type I error respectively. In this study, we assumed the power of the test to be equal to 80% (hence $Z_{(1-\beta)} = 0.84$), and the type I error controlled at 5% ($Z_{(1-\alpha/2)} = 1.96$). The ratio of d/σ is called the effect size which is between 0 and 1. A value as large as 0.20 for effect size is known as very small, 0.50 medium and 0.8 very large effect size. We assumed the effect size to be 0.28 which was enough to discover small changes between the means of two groups if exist. With this arrangement, the total sample size was obtained to be 144 (72 at each group). Participants were selected randomly from the registered households' profiles available at health centers across the city.

3.3. Instruments

In this study, the data were collected through a research-made questionnaire. The questionnaire collected demographic information (8 questions) and also assessed the participant's behavior towards waste separation at home. The questionnaire was used to evaluate our educational intervention program using environmental factors (including 2 yes/no questions, and three Likert questions), one question about behavior of participants for separation of wet and dry wastes, and one question about participant's behavior intention for recycling the waste at home. Environmental factor component mainly assessed the facilities available to participants for waste separation at home. For separation behavior of wet and dry wastes component, behavior intention component, as well as the three questions of environmental factors component, a 5-point Likert scale ranging from never (score 1) to always (score 5) was used. The behavior intention of participants on waste separation was evaluated by asking the participant to express her viewpoint as ‘strongly disagree’, ‘disagree’, ‘neutral’, ‘agree’, and ‘strongly agree’ in response to this question; ‘In coming month, I intend to recycle the wastes at home’. The questionnaire included also questions about attitudes toward behavior (8 questions) with minimum of 8 and maximum of 40 points, subjective norms (5 questions) with minimum of 5 and maximum of 25 points, normative beliefs (2 questions) which is qualitatively reported, perceived behavior control (5 questions) with minimum of 5 and maximum of 25 points, and self-efficacy (8 questions) with minimum of 8 and maximum of 40 points. A 5-point Likert scale ranging from completely disagree (score 1) to completely agree (score 5) was used to measure these components.

The questionnaire was confirmed in terms of formal validity. To assess the content validity, the questionnaire was sent to 20 faculty members who were expert in environmental health engineering and health education. 15 members responded about the questionnaire which resulted in some corrections of the questionnaire The Content Validity Ratio (CVR) and Content Validity Index (CVI) were more than 0.90 and 0.80 respectively, in all subscales. After codification of the questionnaire, this questionnaire was distributed among 20 female housewives. The reliability of the questionnaire was measured by the Cronbach's alpha and the score was 83%. Furthermore, the Cronbach's alpha for the components of questionnaire was as follows; attitudes toward behavior-78%, subjective norms-79%, normative beliefs-92%, perceived behavior control-64%, and self-efficacy-81%.

3.4. Intervention program

In this study, the intervention program was an educational intervention based on IBM on housewife's behavior change towards waste separation at source. Participants attended eight training sessions (two months) receiving information about importance of the waste separation and proper instructions of how to separate waste from home. After a month, participants were asked to fill in a validated questionnaire based on the IBM, before and at the end of study.

3.5. Procedure

The participants in the intervention group were acknowledged by phone about the study purpose, interview process, the voluntary participating and confidentiality of the study. Eight training sessions lasted for two months (one session per week) were designed as a workshop for the test group. The lectures aimed to increase knowledge and awareness of participants. Group discussions and question and answer sessions aimed to change people's attitude towards dry waste separation. To increase perceived power and self-efficacy, a workshop running by women practically practiced separation of dry and wet waste(Mastery Experiences), was designed . In this stage, people began to monitor each

other's behavior and to learn through observation (Vicarious Experiences). We also provided participants with verbal and non-verbal encouragement (Verbal Persuasion) (14). To assess the effect of an intervention, after a month from the last session, the participants were asked to fill in a questionnaire.

3.6. Statistical analysis

For quantitative outcomes, data were expressed as means ± standard deviation and for categorical measurements, the proportions were reported. The normality assumption requires for parametric tests was investigated using a Kolmogorov-Smirnov test (as well as Shapiro-Wilk). For categorical outcomes, McNemar test was used for pre and post comparisons. For quantities data paired *t*-test or Wilcoxon Signed Rank test was used as appropriate. Furthermore, correlation analysis was used to study the association between attitude, subjective norms, perceived behavior control, and self-efficacy components before and after an intervention.

4. Results

Table 1 reports the characteristics of the participants in the study. In training group, the mean age was 34.24 ± 4.69 years and in the control group it was 35.37 ± 5.02 years. This shows a marginal significant difference between the mean age of two groups (Mann-Whitney, $p = 0.041$). The distribution of the education levels showed that most participants (56.94% in training group and 58.33% in control group) and their spouse (51.39% in training group and 54.17% in control group) had a high school degree. In both groups, most families had two children and only 1.39% of families in training group (5.56% in control group) had more than three children. Two groups were different in terms of number of children (Chi-square test, $p = 0.007$).

The results of McNemar's test showed that there was a significant difference in interventional group, over time in effective factor for behavior ($X^2 = 18.74$, $p = 0.044$) and behavior intention for separation of wet and dry wastes ($X^2 = 22.5$, $p < 0.001$) (Table 2).

The results of normality tests showed violation of normality assumption. As a result, Wilcoxon Signed Rank Test was used to compare the median score of components (Table 3). The results showed that the attitude score of the subjects at the baseline (median = 35) was significantly different with the attitude score of the subjects at the end of study (median = 37), ($Z = -2.84$, $p = 0.005$). The subjective norms score of subjects at the baseline (median = 16) was also significantly lower than the endpoint subjective norms score of participants in the training group, median 19 ($Z = -4.22$, $p < 0.001$).

The Wilcoxon non-parametric Wilcoxon test for perceived behavior control variable revealed that there was a significant difference between the perceived behavior control of individuals before intervention (median = 19) and the perceived behavior control score of subjects after the intervention (median = 22), ($Z = -4.481$, $p < 0.001$). The self-efficacy of individuals at baseline (median = 32) was significantly different with self-efficacy score of participants after one month intervention (median = 34), ($Z = -4.014$, $p < 0.001$).

Bivariate scatter plot with a fitted line (on the below of the diagonal), the distribution of each element (main diagonal) and the value of the correlation plus its significant level as stars (upper diagonal) of four components, attitude, subjective norms, perceived behavior control, and self-efficacy, before (Fig. 1) and after intervention (Fig. 2) are presented as plot matrices by Figs. 1 and 2.

A correlation which is significant at 0.001 is shown with three stars, at 0.01 significance level with two stars, and at 0.05 level with one star. In general, correlations were positive and highly significant between self-efficacy and other components. Correlation between subjective norms and perceived behavior control wasn't significant before intervention ($r = 0.16$, $p > 0.05$), but it was statistically significant after intervention at 0.01 level ($r = 0.37$, $p < 0.01$).

Table 1
Distribution of the demographic characteristics of the participants.

Variable	Intervention	Control Group	P-Value
Age (Year) (Mean ± SD[a])	34.24 ± 4.69	35.37 ± 5.02	0.041
Education of participant			
Under the diploma	17 (23.61)	15 (20.83)	0.937
Diploma	41 (56.94)	42 (58.33)	
Associate's degree	1 (1.39)	2 (2.78)	
Bachelor's degree	12 (16.67)	12 (16.67)	
Master's degree and higher	1 (1.39)	1 (1.39)	
Spouse education			
Under the diploma	1 (1.39)	3 (4.17)	0.005
Diploma	37 (51.39)	39 (54.17)	
Associate's degree	12 (16.67)	8 (11.1)	
Bachelor's degree	14 (19.44)	20 (27.78)	
Master's degree and higher	8 (11.11)	2 (2.78)	
Child			
One child	20 (27.78)	9 (12.5)	0.007
Two child	45 (62.5)	45 (62.5)	
Three child	6 (8.33)	14 (19.44)	
Four child	1 (1.39)	2 (2.78)	
Five child	0 (0.0)	2 (2.78)	
(Income) (million Rials)			
< 5	2 (2.77)	1 (1.39)	0.443
5-10	7 (9.72)	11 (15.28)	
10-15	48 (66.67)	46 (63.89)	
> 20	15 (20.84)	14 (19.44)	
Training history on waste separation			
Yes	33 (45.2)	30 (41.67)	0.548
No	39 (54.8)	42 (58.33)	

[a] SD: Standard Deviation.

Table 2
The distribution of participants answers to behavior components for separation of wet and dry wastes before and after study.

	Baseline	Endpoint	P-Value[a]
Behavior of recycling waste (within last month)			
Never	16 (22.2%)	7 (10%)	0.044
Seldom	11 (15.3%)	4 (5%)	
Regularly	16 (22.2%)	13 (18%)	
Sometimes	18 (25%)	28 (39%)	
Always	11 (15.3%)	20 (28%)	
Participants behavior intention			
Strongly disagree	0 (0%)	0 (0%)	< 0.001
Disagree	0 (0%)	0 (0%)	
Neutral	10 (14%)	1 (1%)	
Agree	29 (40%)	17 (24%)	
Strongly agree	33 (46%)	54 (75%)	

[a] P-value obtained using McNemar's test.

5. Discussion

In this study, we investigated the effect of an educational intervention on changing the recycling behavior of housewives in Sanandaj City. Studies suggest several predictors associated with behavioral change.[13,14] but attitudes, subjective norms, and perceived behavioral control are among the most important predictors.[15] Our educational intervention increased the score of attitude, subjective norms, perceived behavior control, and self-efficacy of participants. The mean score of the attitude increased from 35 to 37, subjective norms from 16 to 19, perceived behavior control from 19 to 22 and the mean of the self-efficacy from 32 to 34 after the intervention. Attitude is known as one of the most important predictors of behavior and its key role has been confirmed in various studies.[17]

The level of attitude had a positive correlation with other components so that increasing its level led to better performance of individuals in the process of recycling.[18] The Abd El-Salam et al. (2009) study indicated a positive correlation between knowledge and attitude of

Table 3
The mean, standard deviation (SD) and range of components at the baseline and end of study for intervention based on IBM group after a month.

Component	Baseline (n = 72)			Endpoint (n = 72)			P-Value[a]
	Mean ± SD	Median	Range	Mean ± SD	Median	Range	
Attitude	34.03 ± 5.12	35	17–40	36.00 ± 4.28	37	20–40	0.005
Subjective norms	15.91 ± 4.58	16	5–25	18.90 ± 4.56	19	8–25	< 0.001
Perceived behavior control	18.93 ± 4.01	19	8–25	21.76 ± 2.65	22	16–25	< 0.001
Self-efficacy	31.54 ± 6.79	32	9–40	34.72 ± 4.66	34	26–40	< 0.001

[a] P-value obtained using Wilcoxon signed rank test.

elementary school students so that students with a poorer level of environmental knowledge had a negative attitude toward the environment.[19]

Karout et al. (2012) study investigated the effect of education on knowledge, attitude, and behavior in the management of solid waste. They found a positive association between higher education and attitudes towards better management of solid waste and recycling.[20] Karimi et al. (2015) conducted a study to investigate the effect of an educational intervention through face-to-face training and pamphlet training on the separation, isolation, and recycling of waste.[21] They showed the effectiveness of both training methods towards attitude scores.

Other studies showed a significant and positive correlation between other behavior components so that increasing one component will increase others.[17] In this study, we found a significant correlation between the subjective norms and self-efficacy before intervention. After intervention, the correlation of subjective norms and self-efficacy with perceived behavior control was also significant.

The results of this study showed that the educational intervention was effective in changing housewives' behavior towards recycling waste from home. Taghdisi et al. (2016) found a positive effect for educational intervention on elementary school students.[22] Margai et al. (1997) suggest improvement in waste reduction behavior of East Harlem residents of New York City after an educational outreach program.[23]

Since the present study was a community-based study with short and long-term social outcomes, we couldn't evaluate long-term effects of our intervention mainly due to time limitation. Another limitation of this study was the insufficient support from recycling center and inadequate municipal recycling infrastructures available for households in the city of Sanandaj. However, one of the strengths of this study was the study population which was a mixed population with different cultures and habits. Furthermore, study population was housewives who mainly deal with household affairs and had a great impact on any recycling program.

6. Conclusions

Based on the results of this study, educational intervention can significantly increase the level of behavior components such as attitude, subjective norms, perceived behavior control, and self-efficacy. It can change the behavior of individuals towards separation of waste from

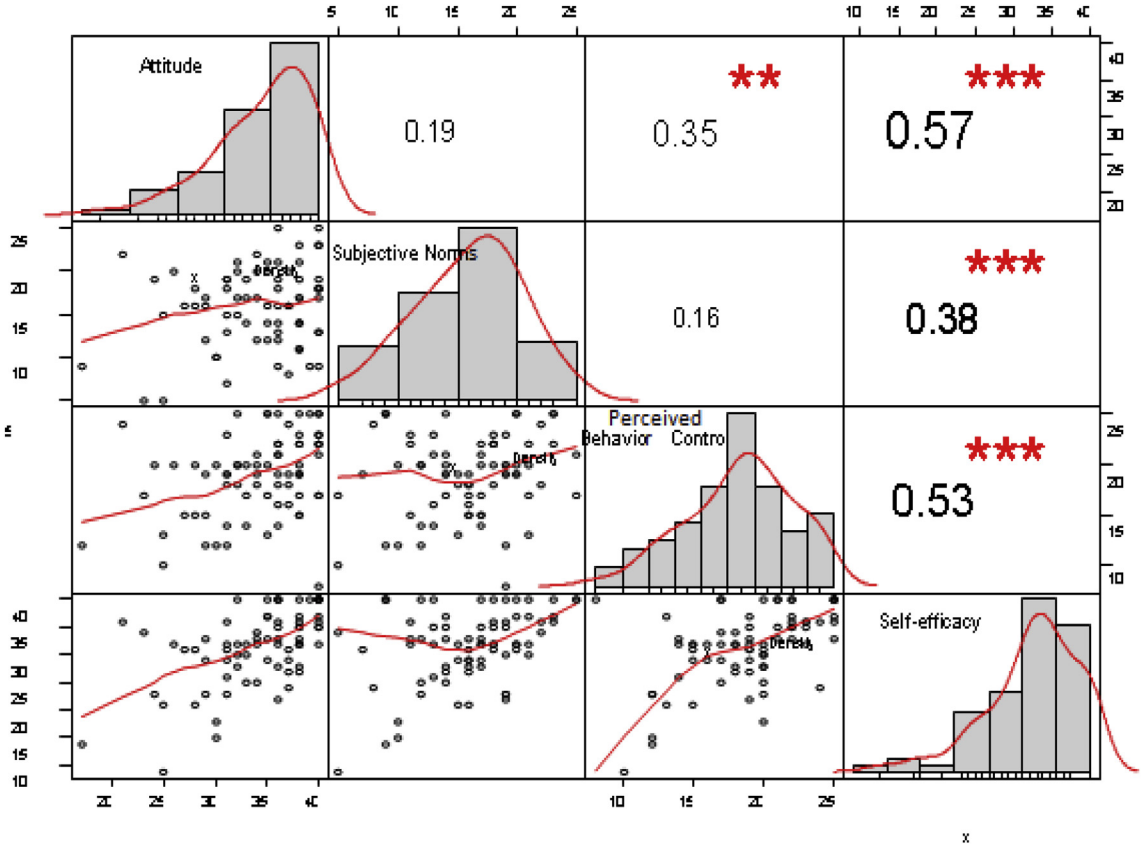

Fig. 1. Correlation between IBM components at intervention group based on IBM at baseline.

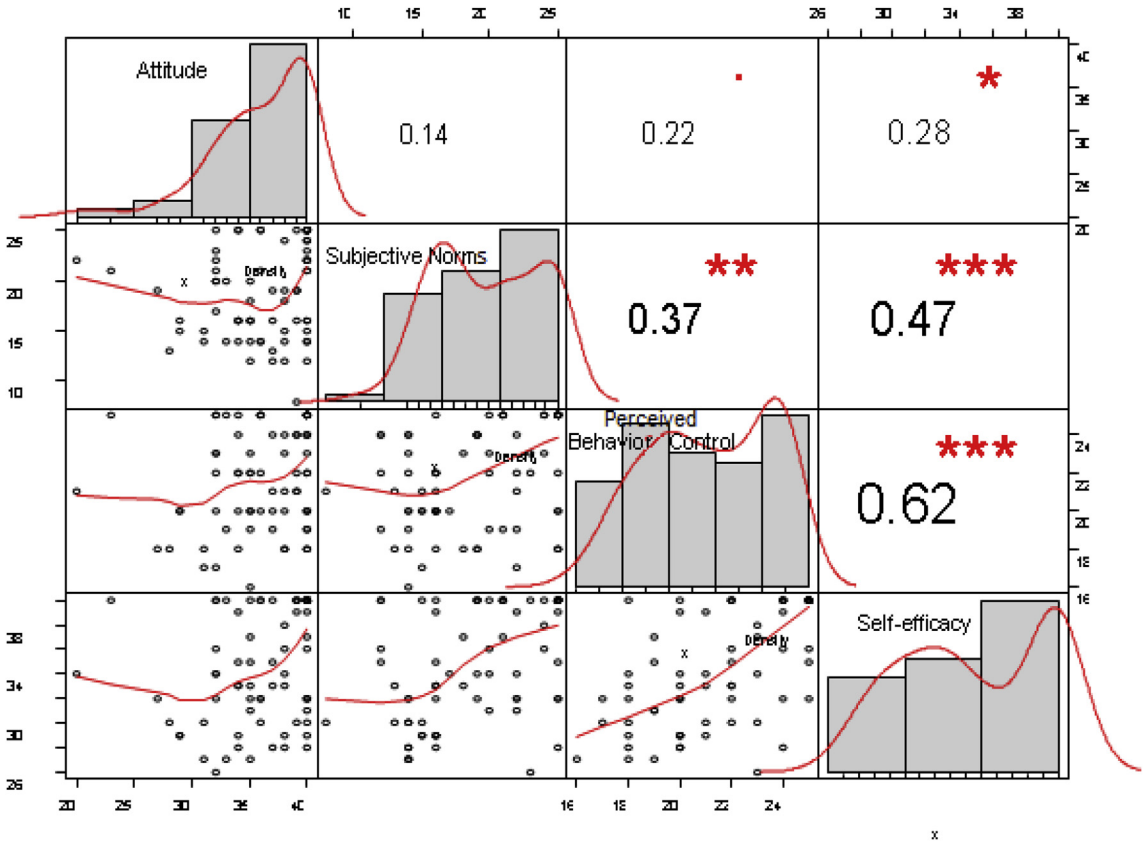

Fig. 2. Correlation between IBM components at intervention group based on IBM at the end of study.

the source (home). Furthermore, the use of this educational intervention on other populations is required to validate the intervention more properly.

Declaration of competing interest

Authors declare no conflict of interest.

Acknowledgments

This study was approved by the Committee on Ethics of Aja University of Medical Sciences, IR.AJAUMS.REC.1396.61. The authors would like to express their gratitude toward the Aja University of Medical Sciences.

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